

## LITHIUM BATTERY RECOVERY AND REUSE PROGRAM

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### INTRODUCTION:

Fort Polk is located in west central Louisiana and is currently the home of the Joint Readiness Training Center (JRTC), the 2nd Armored Cavalry Regiment, the FORSCOM Redistribution Center (operated by Martin-Lockheed), and the garrison's Warrior Brigade. Fort Polk covers 198,963 acres - 98,125 of which belong to the United States Forest Service and it makes up part of the Kisatchie National Forest.

The JRTC mission of training light infantry soldiers in low-intensity conflicts involves the addition of a brigade-sized task force to the installation each month. The aggressive training mission of the JRTC and Fort Polk presents extraordinary challenges to protecting the environment without mission impacts. Visiting and resident soldiers at the JRTC utilize a wide variety of batteries in military equipment during the rotational exercises. The Army currently spends approximately \$70 million annually on the purchase of all batteries. Lieutenant General Reimer, Chief of Staff of the Army, has established a 50% reduction in the cost of battery procurement as an Army wide goal. The JRTC & Fort Polk have, in turn, established a program to help in the reduction of battery expenditures and waste disposal costs.

The use of one specific battery has increased dramatically over the last 18 months. This battery a BA 5590 is a 12-volt lithium battery, with 10 lithium cells and weighs approximately 2.5 pounds. The purchase price for these batteries is \$65.00 each; the disposal cost as a hazardous waste is \$9.22 each.

The BA 5590 is used to power not only communications equipment, but also to power the SAWE II MILES (Simulated Area Weapon Effect [II] Multiple Integrated Laser Engagement Simulator) which locates individuals and equipment on the battlefield. Historically, the use and disposal of these batteries has been managed at the unit and soldier level. However, in 1996 and 1997, the JRTC began fielding the SAWE II MILES equipment and saw a steep increase in the numbers of used batteries being generated and processed for disposal by visiting rotational units. Due to the inherent safety issues surrounding the use and discharge of these batteries, it has been unrealistic for the visiting units to accomplish the discharging, testing, and disposal required for batteries used during their rotations. The rotational units are at Fort Polk for approximately 3 weeks, with only 5-7 days available for clean-up following the exercise. During the time period April 1997 - April 1998, the JRTC used over 24,000 lithium batteries. The increasing use of the SAWE II MILES will result in even greater numbers as the year goes on. As a result of the increased usage and the rather complex testing and disposal procedures, the environmental staff dedicated personnel to oversee the process at the North Fort Polk Consolidated Solid Waste Collection Facility. These individuals collect and process all batteries used during the rotation.

### MATERIALS & METHODS:

The following list of materials are being used for management of the BA 5590 lithium batteries:  
 BA 5590 Lithium sulfur dioxide batteries (NSN:6135-01-36-3495) \$65.00 each  
 Energage LS 94 State-of-Charge-Tester (NSN: 6625-01-370-8278)  
 Standard Multimeter (Voltmeter)  
 Small flat tip screwdriver or similar device  
 Paint pen or permanent marker  
 Tracking form  
 Well ventilated storage area

Batteries are first placed on the state of charge tester to determine their life span. Those batteries determined to have more than 70% of their life span remaining are stored and issued out upon request. Batteries with readings less than 70% are then further processed. Batteries (older versions) which do not have a complete discharge device (CDD) are disposed of as a hazardous waste, for ignitability (D001) and reactivity (D003). Batteries having a CDD are then activated. To activate a CDD you must remove the clear plastic strip covering the CDD then using a small flat tip screw driver or similar device, you press down on the small metal activation switch. These batteries are then dated and allowed to set for 5 days in a well-ventilated area; each battery must be separated by at least two inches on all sides. Once the 5 days have passed the batteries are again tested this time using a standard multimeter. If the voltage reading is below 4, the battery will be marked with that reading along with the initials of the individual conducting the test. The battery is then logged by serial number and is considered non-hazardous waste and can be disposed of in the installation refuge. Those batteries exceeding the 4 volts have faulty CDD's and must be disposed of as a hazardous waste, D001 and D003.

#### RESULTS:

On average, 29% of the batteries processed have greater than 70% of their life span remaining and may be re-issued. Re-issue of the BA 5590 lithium batteries has resulted in an annual cost savings to the Army of well over \$280,000. Another \$190,000 is saved annually (cost avoidance) with the processing of the batteries and disposal of 58% as non RCRA wastes. This left only 13% of the batteries needing to be disposed of as a hazardous waste. Disposal costs average \$9.22 each (DRMO disposal, and proper packaging). Table 1 indicates the costs associated with BA 5590 battery management prior to implementing the state-of-charge testing and battery re-issue.

TABLE 1. PREVIOUS MONTHLY LITHIUM BATTERY PROCESSING

COST CATEGORY (ACTIVITY)	BATTERIES PROCURED	LIFECYCLE COST*	ANNUAL COST
MINES BATTERIES	1500 each rotation	\$74.22	\$1,113,300
SINGAR BATTERIES	900 each rotation	\$74.22	\$667,980
320 MAN HOURS @	\$10.00 ea.		\$3,200
TOTALS	2400 each rotation		\$1,784,480

\* Life cycle costs are the cost of procurement and disposal. Each battery costs \$65.00 to procure; hazardous waste disposal cost is \$9.22 per battery.

## TABLE 2. CURRENT MONTHLY LITHIUM BATTERY PROCESSING

COST CATEGORY (ACTIVITY) BATTERIES PROCURED LIFECYCLE COST\* ANNUAL COST MILES BATTERIES 1500 each rotation 66.20 \$993,000 SINGAR BATTERIES 465 each rotation 66.20 \$302,976 620 MAN HOURS @ \$10.00 ea \$6,200 TOTALS 1965 each rotation \$1,302,176 \*Life cycle costs are the cost of procurement and disposal. Each battery costs \$65.00 to procure; hazardous waste disposal cost is \$9.22 per battery. Only 13% of the batteries are disposed of as hazardous waste, therefore, disposal costs are reduced by 87% (averages \$1.20 each).

## TABLE 3. LITHIUM BATTERY COST AVOIDANCE REALIZED EACH MONTH AT JRTC & FORT POLK

Cost Savings/Cost Avoidance Data Dollars/month of JRTC Rotations Battery Procurement Avoidance \$28,275 Battery Disposal Avoidance \$19,772 Increased Personnel Management Costs (\$3000) TOTAL \$45,047

Note that Table 1 indicates that all that all lithium batteries were managed and disposed of as hazardous wastes. In Table 2, the results of two cost avoidance processes are evident. First, all lithium batteries are tested and reused whenever possible. Approximately 29% of the batteries are reused. Secondly, any battery not showing at least 70% of its life-span is further processed to determine if they are to be disposed as a hazardous waste or a solid waste. As a result, only 13% of the batteries have been disposed of as a hazardous waste.

Increased management of lithium BA 5590 batteries has paid off at the JRTC. As evident in Table 3, the JRTC is realizing over \$45,000 in cost avoidance during each monthly rotation. The JRTC has averaged 11 rotations annually during the past two years. The cost avoidance realized by the program have been secondary to the benefits seen in environmental compliance, waste reduction, and worker health and safety. Having trained personnel working with the batteries has reduced the potential injury to soldiers during the testing and handling. These are dangerous batteries and violent discharges do occur. The personnel working with the batteries are trained to operate the equipment safely and utilize personal protective equipment to avoid exposure to the acid gases in the event of a violent discharge. Soldiers are instructed not to activate the CDD prior to battery turn in, thus reducing the potential chances that the heat generated during the routine discharge process could ignite a fire.

Other installations attempting to implement a system like this must be aware of the Army's guidance on the safe management of lithium batteries. This is available through the following publications: Technical Bulletin (TB 43-0134), Battery Disposition and Disposal, Headquarters, Department of the Army, 1 October 1996 and Logistics Engineering Management Power Sources Team, Ground Precautionary Message (GPM-96-012). The GPM's provide necessary information on the proper disposal of lithium batteries as well as safety information. Several battery vendors are available, PCI (Power Conversion Inc), Ballard, and SAFT. It should be noted that all batteries included in this study were manufacture by PCI. Safety issues identified

in the GPM's precluded reuse of any SAFT BA 5590's. For more information on this project contact Mr. Jeffry Ross, 318-531-6578 (DSN 863-6578) HYPERLINK mailto:rossj@polk-emh2.army.mil rossj@polk-emh2.army.mil or Christine Hull, Ph.D., 318-531-6084 (DSN 863-6084) HYPERLINK mailto:hullc@polk-emh2.army.mil hullc@polk-emh2.army.mil or visit the JRTC & Fort Polk web site: HYPERLINK http://www.jrtc-polk.army.mil/index.htm http://www.jrtc-polk.army.mil/index.htm .

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